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TOXIC HAZARDS OF THE NEWER INSECTICIDES AND HERBICIDES

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During the past 15 years, and particularly since the war, the application of chemicals for weed and pest control has increased enormously, introducing serious hazards both to agricultural and horticultural workers and to farm livestock. The potential dangers to livestock inherent in the current trend towards ever greater coverage of crops with the newer insecticides and herbicides, must result in the veterinary profession being called upon to meet these hazards, and to give advice on how livestock can best be protected from the harmful nature of such materials when spraying operations are contemplated or put into operation.

In order to mitigate some of these hazards so far as agricultural and horticultural workers are concerned, the Agriculture (Poisonous Substances) Regulations, 1953, were introduced, coming into operation on March 31st, 1953. These regulations prohibit certain operations, involving the use in agriculture of substances specified in the Regulations, unless the prescribed protective clothing is worn, and the number of hours during which a worker may be engaged on such operations is restricted. Workers under the age of 18 years may not be engaged on these and certain other operations at all. Obligations are imposed on workers to adopt certain measures for their protection and to refrain from acts considered dangerous. The Regulations also contain provisions as to working in greenhouses, the provision and maintenance of protective clothing, the provision of washing facilities for workers, the notification of sickness and of absence, the training and supervision of workers, the keeping of registers, and other matters.

Chemicals used in the control of weeds and pests may be conveniently graded into two main groups, those relatively harmless to man and animals and those which are potentially dangerous to both man and livestock.

(*a*) RELATIVELY HARMLESS

MCPA, 2 : 4D, tar oils, sulphuric acid, and the chlorinated hydrocarbons such as DDT, benzene hexachloride, chlordane, and toxaphene.

(*b*) POTENTIALLY DANGEROUS

(i) Nicotine formulations.
(ii) Arsenicals and related compounds.
(iii) Dinitro compounds.
(iv) The organo-phosphorus compounds.
(v) Rodenticides.

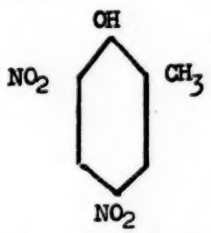
For the purpose of this article we intend to deal only with those substances in group (*b*) and to omit sections (i) and (ii), since there is considerable literature of long-standing authority dealing with these chemicals. Section (v) will be considered in a later publication. A rough idea of comparable toxicity between the two groups is supplied by Thori (1952), who published the following values :—

Toxicity compared to DDT treated as one unit

TEPP	=	125
Parathion	=	70
Toxaphene	=	4
Chlordane	=	4
BHC	=	0·5

DINITRO COMPOUNDS

These compounds, particularly Dinitro - ortho - cresol (DNOC), have been used increasingly in this country since 1938. DNOC has been used as an ovicide in orchards during winter months and for the control of weeds in summer crops, particularly cereal crops, when it is used in a strength varying from 1 to 3 per cent., depending on high or low volume spraying operations.



4 : 6-Dinitro-o-cresol (DNOC).

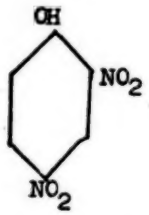
DNOC is a yellow crystalline solid having a melting-point of 86° C., a slight odour, and a vapour pressure of 5·2 by 10^{-5} mm. Hg. It is only slightly soluble in water (130 p.p.m.) at 15° C., although solutions may be obtained in alcohol, aromatic oils, and xylene (40 per cent.). DNOC residues may be determined by extracting with ether, conversion to the sodium salt and measuring the colour intensity at 440 mμ (AVENS, *et al.*, 1948). It forms a yellow sodium salt difficult to remove from skin or clothing.

DNOC can be absorbed orally, through the lungs, or by absorption through the skin. The most likely sources of poisoning during spraying are from inhalation of spray and skin absorption. Both DNOC and dinitrophenol (DNP) increase the basal metabolism and the latter has been used in clinical medicine for the control of obesity. Initial signs of poisoning in man are headache and intense nausea, marked sweating and thirst, vomiting and respiratory distress. There is a case on record (Steer, 1951) of a farm worker who died after spraying DNOC for several days. Death occurred within a matter of hours from the initial appearance of symptoms. Shortly before death generalised convulsions were present, the patient became comatose and was unable to swallow. There was a *post-mortem* lividity and marked *rigor mortis*, especially in the back, within 45 minutes, a delayed clotting time being observed. A rapid appearance of *rigor mortis* is also observed in animals after poisoning with this material, and it is equally as poisonous to animals judging by the limited work which has been carried out.

Parker, Barnes & Denz (1951) have determined the LD_{50} for rats and mice as 24·6 and 24·2 mg. per kg. respectively and claim a similar toxicity for rabbits, guinea-pigs and dogs. Susceptibility was increased by rise of temperature,

and sub-lethal doses could be administered daily for some weeks without cumulative effects. At Weybridge, experimental feeding of pigs has shown that the average single lethal dose is between 50 and 100 mg. per kg. This means that a 150 lb. pig could ingest a fatal dose from 10 square yards of sprayed pasture, assuming all the sprayed material was eaten. This is improbable, but obviously the additional area required to secure such a dose is small. These conditions apply to areas sprayed at the level of 6 lb. DNOC (60 per cent.) per acre.

The estimation of blood levels of DNOC is comparatively easy (Harvey, 1952), and King & Harvey (1953) have studied the blood decay curves in man, the rat, and the rabbit. The ability to eliminate DNOC appears to be in the order rabbit > rat > man, and for the blood storage it is suggested that the extracellular fluids are the principal internal stores of the compound, since albumin links with DNOC. The muscle rigor is the prominent feature of DNOC poisoning, and Stoner *et al.* (1952) have studied the effect on the muscle organic phosphates and shown that the concentration of phosphocreatine was reduced by 92 per cent. and that of adenosine phosphates by 62 per cent., and that the inorganic phosphates rose, glycogen stores disappearing. In general, the results are those expected from an uncoupling of phosphorylation and oxidation. Parker and co-workers (1951) suggest that adenosinetriphosphate (ATP) cannot be resynthesised and that it is progressively broken down to adenylic acid as the muscle goes into rigor. Lundsgaard (1930) has produced similar results with iodoacetic acid. The effect of DNOC on bees has also been studied, and Hammer (1953) has reported on the disastrous effects of hormone weed-killers, especially DNOC, on the bee population in Denmark.



2:4 Dinitrophenol (DNP).

DNP is a colourless crystalline solid having a melting-point of 114° C. and a characteristic odour. It is only slightly soluble in water at 15° C., but is soluble in hot water, alcohol, and ether. DNP has been used in smaller amounts than DNOC to date, and work so far carried out in this laboratory indicates that although in the same toxicity class as DNOC, it is not, relatively speaking, quite so poisonous. Approximately three to four times the doses of DNP are required for the same lethal effect as DNOC.

Knowledge of the physiological action of DNP is limited. Sacks *et al.* (1952) have studied the effect of DNP on the turnover of the acid-soluble phosphorus of rat diaphragm. Using isolated rat diaphragm and three different concentrations of DNP, they found (*a*) stimulated respiration with no effect on ATP but the amount of hexose monophosphate (HMP) turned over was increased ; (*b*) initial stimulation of respiration followed by a profound depression of respiration, phosphocreatine being completely hydrolysed, and the ATP and HMP concentrations reduced. Wollenberger & Karsh (1952) determined the effect of a cardiac glycoside (ouabain) on the contraction and energy-rich phosphate content of the heart poisoned with DNP. Their experiments with perfused guinea-pig heart showed an 80 to 90 per cent. decrease in amplitude of contraction and almost complete disappearance of phosphocreatine. Small amounts of ouabain, normally non-toxic, became highly toxic. Peiss & Field (1952) have studied the effect of DNP on the oxidation of various substrates by rat brain. The oxygen consumption of cerebral cortex slices in Krebs-Ringer phosphate containing 0·011M sodium pyruvate was augmented by concentrations of DNP ranging from 2·5 by 10^{-6}M to 1·3 by 10^{-4}M. A concentration of 2·23 by 10^{-3}M inhibited respiration in all substrates by 30 to 40 per cent.

The Organo-phosphorus Compounds

These are beyond doubt the most dangerous group of compounds used in agriculture to date. The work which introduced these substances was carried out just before, and after the late war by Professor Schrader in Germany (1947).

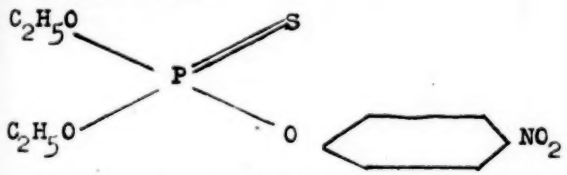
Their development has been prompted by the desire to find a perfect selective systemic insecticide. A selective systemic insecticide is one which possesses the properties of being absorbed into the sap of plants, remaining active and soluble in the sap for a reasonable period, and being toxic to pests but non-toxic to their predators and parasites. The advantage of the selective systemic insecticide over the general insecticide is that it is non-toxic to the predators and parasites of the pests, so that those few pests inevitably remaining after spraying are quickly obliterated. With the general insecticide although a high mortality of the pest may be achieved, an equal percentage of beneficial insects is destroyed, and the residual pests are able to multiply again unchecked by natural means. In the latter event, according to Volterra's " Third Law of the Disturbance of Averages " (1928) an even higher infestation by the pest will result. The first systemic insecticidal properties were observed with selenium compounds, but since the toxicity of these was long-lived and they are very harmful to man and animals, attention is now focused on organic fluorine and organo-phosphorus compounds. Schradan was the first selective systemic insecticide to be used on a commercial scale, and after exclusive use in the contract service of Pest Control, Ltd., was released on the home market several years ago as Pestox III. Several firms now prepare for commercial sale Parathion, Schradan, HETP, and TEPP, each firm having its own particular formulation of active products plus wetting agents, etc., but strength for spraying obviously depends on whether it is a first spraying or reinforcement spraying, and for what particular purpose the product is to be used.

In this country no deaths have been reported to our knowledge, although there have been several human hospitalisation cases, one being reported by Milles & Salt (1950) and successfully treated by atropine therapy. In the U.S.A. there have been many cases of Parathion poisoning, including several deaths in the early days of general spraying with this material. One incident concerned a foreman in charge of spraying who, with another worker, was splashed on the hands and clothes. He correctly ordered his assistant to strip off contaminated clothing and wash the affected skin areas, neglecting to change his own clothing. He died of Parathion poisoning several hours after admission to hospital. A second incident concerned a sprayer working on a peach orchard in California. He had spent the whole of a hot day spraying trees and absorbed sufficient spray on exposed areas and via the lungs to prove fatal.

With all the organo-phosphorus compounds entry to the body can be gained via the alimentary tract, the lungs in normal respiration, by absorption through the skin, or into the eyes. The pharmacology of the group has been extensively studied over the last few years, and it is known they

cause an inhibition of cholinesterases, the production of a muscarine-like effect on the parasympathetic nervous system, and a nicotinic effect on the somatic motor nerves. There is evidence showing that the cause of death is usually respiratory failure (Frawley *et al.*, 1952; Douglas & Mathews, 1952), and if artificial respiration is applied larger doses of organo-phosphorus compounds may be tolerated by experimental animals (Douglas & Mathews, 1952; Papworth, 1952). Poisoning in man is manifest by an initial sense of well-being. A worker so poisoned should be removed from work where further material could be absorbed. Giddiness and headache, tendency to vomit, a tight feeling of the chest, and constricted pupils are the early clinical signs. These are quickly followed in serious poisoning cases by continual vomiting, profuse sweating and salivation, muscular twitchings of the limbs, involuntary straining and defaecation, incontinence of urine, respiratory distress with pulmonary oedema, followed by coma and death due to respiratory failure. A similar chain of symptoms is observed in animals, perhaps the most useful and obvious signs being very copious salivation and lachrymation (with or without frothing at the mouth), hypermotility of the intestines visible through the abdominal wall, and the muscular twitchings of the limbs.

Fortunately the stability of these compounds after spraying is not long-lived. The degree to which they are broken down to relatively harmless products varies according to weather conditions. It has been shown (Fahey *et al.*, 1952) that during periods of uniform temperature and absence of rainfall the rate of loss of Parathion from spray deposits is a function of the logarithm of the time elapsed. Generally it may be assumed that sprayed crops are safe for marketing after four to five weeks.



O, O Diethyl O-p-nitrophenyl phosphorothionate (Parathion, E.605).

Parathion, the commercial product, is 95 per cent. pure and is a deep brown liquid with a characteristic odour. The pure compound boils at 375° C. and the vapour pressure at 25° being 0·0006 mm. Hg, gives it a fumigant toxicity. Parathion is slightly soluble in water, completely miscible with all alcohols, esters and aromatic hydrocarbons, and at alkaline *p*H is rapidly hydrolysed to p-nitrophenol and diethyl-o-thionphosphate. It is not affected by oxygen or ultra-violet light, but if stored in glass bottles loses 50 per cent. of its activity in six months (Brown, 1951).

The insecticidal properties of this material were discovered by Schrader in 1944 and first reported by Martin & Shaw (1946). It is usually put up in the form of an emulsion containing 2 lb. of the active material per gallon, together with solvent and wetting agent, and is used as a contact insecticide against a wide range of insect pests.

Konst & Plummer (1950) were among the first to study the toxicity of Parathion in mammals, and found that acute oral toxicity varied according to the species tested. Rabbits appeared most resistant, followed by the male mouse, male rat, and guinea-pig; the female rat showed exceptionally low tolerance which was only slightly higher in the chicken. They also claimed that on the basis of bodyweight, sheep and swine showed only slightly greater resistance to oral or dermal administration than laboratory animals. So far as oral toxicity is concerned, our own experiments show that swine have less resistance on a bodyweight basis. Fig. 1 shows the LD_{50} values reported by Dubois *et al.* (1949) (intraperitoneal inoculations).

Fig. 1

Animal	*LD_{50} mg per kg.*
Male rat ...	7
Female rat ...	4
Cat	3–5
Mouse	5–10
Dog	12–20
Female rat ...	6 (oral administration)
Male rat ...	15 („ „)

These workers were able to show an interesting sexual difference towards toxicity. Administration of testosterone propionate to female rats will raise their resistance level to that of the male and, conversely, castration will increase the susceptibility of the male rat to poisoning.

At Weybridge, experiments have been carried out on laboratory animals and on swine to assess the acute toxicity of Parathion. In one experiment a pig weighing 40 lb. was fed a capsule containing 0·5 ml. of 98 per cent. Parathion. Within three hours the animal showed marked symptoms of poisoning along the lines mentioned above. There was acute salivation and frothing at the mouth, involuntary muscular twitching, and partial paralysis, the animal lying on its side with legs, tail and ears twitching. The animal was then shot, after twitching of the eyelids and nystagmus, with a grinding of the teeth became apparent. *Post-mortem* examination revealed no marked pathological changes. Lungs, heart and abdominal viscera were apparently normal. There was a marked hypersensitivity of limbs and abdominal musculature, and the stomach contents were thin and watery.

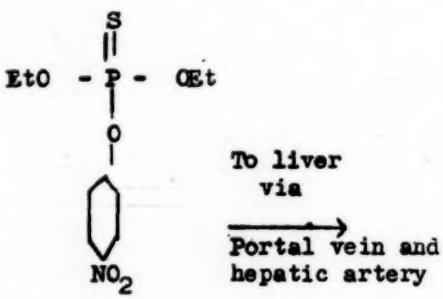
Since there is evidence available to support the theory that sublethal doses of the organo-phosphorus compounds have a cumulative action, we also fed a pig weighing 47 lb. one capsule daily containing 0·05 ml. of 98 per cent. Parathion. For the first six days of the trial the pig showed no apparent discomfort or unusual symptoms. On the seventh morning, about an hour after receiving the usual capsule, the animal coughed up blood, showed a partial paralysis of the hind legs, no abdominal muscle tone, and was shot. *Post-mortem* examination was negative, except for signs of patchy gastritis.

Konst & Plummer (1950) investigated the acute oral toxicity of Parathion in male sheep, and found that a single dose of 60 mg. per kg. caused death within four hours; also that two doses of 25 mg. per kg. at one week's interval between the doses caused death within one and a half hours of the second dose. Doses of up to 40 mg. per kg. when given at monthly intervals, however, did not have any fatal results.

Pankaskie *et al.* (1952) recently carried out studies on the feeding of Parathion to cows. Parathion in the form of an excessively heavy experimental residue of approximately 14 p.p.m. on baled alfalfa hay, was fed over a 61-day period to five dairy cows (in mid-lactation and representing four of the major breeds). The average Parathion intake for all cows during the period was 166·9 mg. per cow per day, or 0·33 mg. per kg. of cow bodyweight a day. Neither Parathion nor free p-nitrophenol—a probable hydrolytic product of Parathion—was ever found in the milk or jugular blood. The feeding trial had no adverse effects on milk, weight, or general health. They also studied the degradation and detoxication of the substance. No Parathion, free p-nitrophenol, or free p-aminophenol was ever found in samples of blood, urine and milk taken during the experimental period. The evidence indicated that Parathion must be hydrolysed *in vivo*

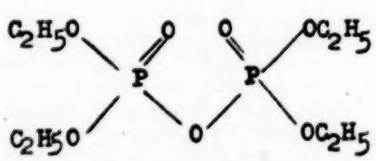
to p-nitrophenol, reduced to p-aminophenol, conjugated with glucuronic acid, and excreted as p-aminophenyl-glucuronide. The fate of the thiophosphoric acid portion of the molecule was not determined.

The probable mode of action of Parathion has been suggested by *in vitro* studies to be the inhibition of the enzymes called cholinesterases, largely present in the red cells, although in some species there may be relatively high plasma levels. Dubois *et al.* (1949) found that the *in vitro* inhibition of cholinesterases by Parathion could be increased many times if the Parathion was first incubated with certain tissue slices, of which liver was the most efficient. It is now generally accepted that Parathion is relatively harmless, but that transport through the liver causes the production of Paraoxon, which is a very powerful inhibitor of cholinesterases. Aldridge has published work on the inhibition of specific cholinesterase (1950), and Diggle & Gage (1951) reported on the *in vitro* cholinesterase inhibition of a series of samples of Parathion and of similar compounds, using a rat-brain homogenate as a source of specific cholinesterase. They found that the S-ethyl and S-phenyl isomers of Parathion, and the oxygen analogue (Paraoxon) have a powerful inhibitory action ; also that the inhibition of different samples of commercial Parathion can be ascribed to contamination with the S-ethyl isomer of the compound. The general picture *in vivo* may be described as :—



Parathion
(E.605).

This chain of events accounts for the small time-lag between admission of the Parathion to the blood stream and the powerful inhibitory effects plus symptoms of severe poisoning. One of us (Papworth, 1953) has studied this delayed action using a nerve-muscle preparation of the intact rabbit under nembutal anaesthesia. Enders (1952) has studied the action of Parathion on circulation, and found that it caused hypotension which is antagonised by atropine. It is capable of diminishing the stroke volume of frog heart, and causes increased venous pressure in mammals and delayed conduction in the heart. Atropine does not counteract these effects.



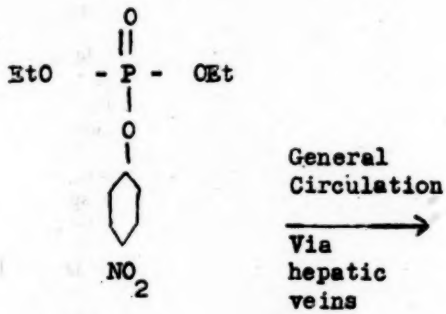
Tetraethyl pyrophosphate
(TEPP).

There does not seem to be a great deal of reliable data on the dermal toxicity of Parathion. Konst & Plummer (1950) found that doses of from 30 mg. per kg. to 200 mg. per kg. killed all treated rabbits within 24 hours. Those which received 20 mg. per kg. or less, survived. Dermal application to swine in single doses of 15, 20 or 30 mg. per kg. bodyweight did not result in any fatalities. We have found that with the laboratory rat, 0·025 to 0·050 ml. applied to a shaved patch on the back was capable of causing death within one or two hours.

As stated earlier, *post-mortem* symptoms, apart from the hypersensitivity of muscle, are mostly negative. It has been claimed by Lehman (1948), however, that tissue damage caused by this poison includes enterocolitis in the alimentary canal and necrosis of the gall bladder. Antagonists of Parathion include atropine, physostigmine, nicotine, and magnesium sulphate, of which the first two are the best, increasing the dose required to kill by six to eight times (Papworth, 1953 ; Dubois *et al.*, 1948 ; Hagan & Woodard, 1948).

HETP and TEPP are analogous in their behaviour and uses, and it is convenient to consider them together. For agricultural purposes TEPP generally refers to a mixture of polyphosphates containing at least 40 per cent. TEPP.

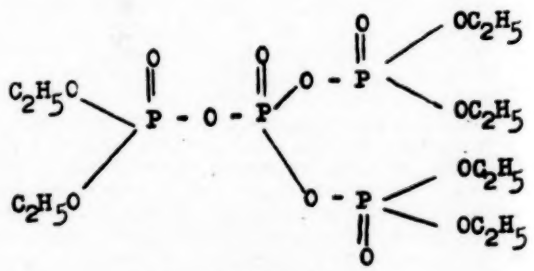
HETP is a light amber, oily liquid whose freezing-point is about − 40° C. and which on heating decomposes at 145° to 150° C. It has a specific gravity of 1·28 and may be



Paraoxon
(E.600).

prepared by reacting 9 moles of ethyl alcohol with 4 moles of phosphorus oxychloride, or by reacting 2 to 3 moles of triethyl phosphate with 1 mole of phosphorus pentoxide.

TEPP is a colourless to dark amber liquid whose freezing-point is below −60° C. and which decomposes about 165° C. It has a specific gravity of 1·19 and boils at 150° C. at 10 mm. Hg pressure. Pure TEPP can be prepared by treating silver pyrophosphate with ethyl iodide or may be isolated from commercial TEPP. The latter rapidly hydrolyses in water,



Hexaethyl tetraphosphate
(HETP).

but HETP is hydrolysed at an even faster rate, and as a result of the formation of free phosphoric acid, both substances are highly corrosive to metal containers.

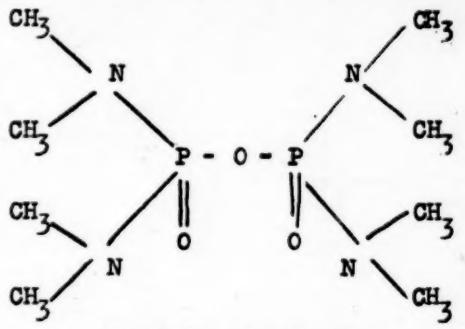
Both HETP and TEPP have a very rapid toxic action, since they do not require conversion by the body into a more toxic material for their physiological effect. The oral LD_{50} has been reported as 7 mg. per kg. for HETP in mammals (Lehman, 1948), and TEPP, which is about six times as toxic as the former, was shown to have an LD_{50} of 1·4 to 2·0 mg. per kg. for rats (Mangan, 1947). Both substances are readily absorbed through the skin and the lethal dermal amount covers a range of about 10 to 50 mg. per kg. Lehman has produced evidence suggesting that a small drop of pure TEPP in the eye might be sufficient to kill a man. Despite the foregoing data, because of the rapid hydrolysis of these compounds, they are not as dangerous in residual forms after spraying as are Parathion and Schradan. HETP and TEPP both have a strong inhibitory effect on the cholinesterases, TEPP being the most potent of the organo-phosphorus compounds in this respect (Dayrit *et al.*, 1948 ; Dubois & Mangan, 1947).

Symptoms produced by poisoning with these two substances follow the general pattern observed with Parathion, with the exception that there is a much smaller delay between absorption of the poison and appearance of symptoms. One unusual feature with HETP is a suggestion that it may be carcinogenic. Lewis (1952) has reported a human clinical case of HETP poisoning in which carcinogenic action is suggested by the appearance of bronchogenic carcinoma in the patient 10 months after exposure to the substance. Little work has been published on the effect of these two compounds on domestic livestock ; since they are rapidly decomposed, however, the risk of poisoning appears slight.

There are several papers on the physiological action of these substances. Douglas & Mathews (1952) have studied the cause of death in cats by TEPP poisoning. Injections of 0·3 to 0·6 mg. per kg. caused death by respiratory failure ; the responsible factors for this were paralysis of the respiratory muscles and failure of the respiratory centre, bronchorestriction occurred but played a secondary rôle. Paralysis of the respiratory muscles was due to neuromuscular block. The block showed the characteristic features of cholinesterase inhibition, and probably resulted entirely from accumulation of acetylcholine at the end-plate region. If the transient paralysis of the respiratory muscles was controlled by artificial respiration, atropine or hyoscine administration prevented death from much larger doses than were normally required for fatal effects.

Samson Wright *et al.* (1949) investigated the action of HETP and TEPP on the nerve-muscle preparation and the CNS of the cat. They found these two compounds potentiate the mechanical response of the nerve-muscle preparation to single motor volleys. Using belly-tendon leads, the electrical response was characteristically modified by the addition of further waves after the initial diphasic wave, and they referred to them as " peripheral after-discharge " which might be repeated for up to a second. HETP and TEPP facilitated various reflexes such as the knee jerk, flexor, crossed extensor and jar reflex, and induced convulsions.

Schradan is a colourless viscous liquid with a characteristic odour and specific gravity of 1·24. It has a boiling-point of 154° C. at 2 mm. Hg, and is miscible with water, organic solvents, and aromatic oils, and immiscible in paraffin oils. The compound may be prepared by combining 4 moles of dimethylamine with 1 mole of phosphorus oxychloride. The resulting bisdimethylaminochlorophosphine oxide is converted to the sodium salt of the phosphoric acid and combined with more of the phosphine oxide. Schradan is not hydrolysed by water or alkali, but is susceptible to acid hydrolysis yielding dimethylamine and phosphoric acid.



Octamethylpyrophosphoramide
(Schradan, Ompa, Pestox III).

Schradan is of considerable interest as it was the first selective systemic insecticide to be prepared (by Schrader, see above).

Pestox III is a liquid containing dimethylamides of polyphosphoric acids which are insecticidally equivalent to not less than 66 per cent. Schradan. It kills aphids on spinach, sugar beet, mangolds and tobacco, but does not destroy bees or beneficial insects.

Schradan appears to be less toxic to mammals than Parathion. Oral LD_{50} values for the rat were found to be between 10 and 22 mg. per kg. (Dubois *et al.*, 1950), 35 mg. per kg. for the guinea-pig, and 60 mg. per kg. for the rabbit. The median lethal dose on skin inunction was 200 mg. per kg. compared to 63 mg. per kg. for Parathion (Ripper *et al.*, 1949).

Feeding of pigs with Schradan at Weybridge has shown them to be rather susceptible to the poison. One pig weighing 53 lb. was fed a capsule containing 0·5 ml. of 66 per cent. Schradan at 11 a.m. Until 1 p.m. the animal appeared perfectly normal, when it showed a tendency to collapse on the forefeet, shivering, and a slight frothing at the mouth. Within the next two hours the animal showed all the usual symptoms of organo-phosphorus poisoning and was shot at 3 p.m. *Post-mortem* examination revealed nothing abnormal. The accumulative poisoning action was also tested on a pig weighing 47 lb. A capsule containing 0·05 ml. of 66 per cent. Schradan was fed daily to the animal. There were no signs of poisoning or discomfort until the morning of the ninth day. During this day there was a tendency to keep the head lowered, there were signs of reduced abdominal tone and slight frothing at the mouth. The animal was shot later in the day and *post-mortem* examination was negative. The rat and rabbit were found to be much more resistant on a bodyweight basis than swine.

The mode of action of Schradan *in vivo* is very similar to that of Parathion already described. Gardiner & Kilby (1952) showed that a 50 per cent. inhibition of whole rabbit blood cholinesterase was caused by one hour's incubation with 2·6 by 10^{-2}M Schradan. Despite this low inhibitory action, the *in vivo* administration led to death with the symptoms of acetylcholine poisoning. Using radioactive Schradan they showed that the compound is converted *in vivo* into some more active anti-cholinesterase, and that incubation of Schradan *in vitro* with rat or rabbit liver slices led to an enhancement of inhibitory activity. The active material after liver-slice incubation can be dialysed into buffer and extracted with chloroform ; it is labile and destroyed by five seconds' exposure to 0·033N alkali, but is

slightly more stable to acid. Other workers (Hofmann-Credner & Siedek, 1952) supply confirmatory evidence by following the fate of Schradan labelled with P^{32} in mammals. It was found that Schradan was mostly decomposed in the liver, and a much smaller amount in the bile, faeces, and urine. Cheng & Kwok-Kew (1951) carried out total hepatectomy on rats and found they lived 8 to 10 hours without glucose injections, and survived doses of Schradan which could kill control rats in less than 30 minutes. The active *in vivo* inhibitor appears to be an oxidation product of Schradan, this change being similar to the metabolism of Parathion which is converted to Paraoxon *in vivo* by the liver.

The cumulative effect of Schradan has also been confirmed. It has been found possible to induce a tolerance to the substance by gradually increasing the daily dose, or by treating the animals daily with a sublethal dose for a longer period. Rats prepared in such a manner were able to tolerate for several weeks, without symptoms, a daily dose which would normally kill all animals in a few days. No gross or microscopic pathological changes were seen in the organs of the rats so examined ; one group ingested 0·5 mg. for 56 days, increased to 1 mg. per day for 26 days without fatality (Rider *et al.*, 1952).

Conclusion

We are satisfied that with the livestock feeding trials described, half the doses given would probably have proved fatal to the animals. With spraying at the normal rate, lethal doses may be ingested from several square yards of sprayed crops, especially with the organo-phosphorus compounds. It is obvious that a heavy responsibility rests with the individual supervising such spraying and on managers of livestock in the vicinity of spraying operations. The precautions to be taken for the protection of animals are clearly evident. All toxic compounds should be kept under lock and key, and free from exposure to inclement weather, so that rain may not wash out material on to grazing land or the living quarters of livestock. The two factors which have operated so far to prevent much harm to livestock are the rapid breakdown of these substances by normal weather conditions and the almost complete control of these compounds by large companies who have sprayed on a contract basis, and whose employees are well-trained in the hazards to which they and animals are exposed from such materials.

Aldridge & Barnes (1952) in a discussion on the problems of assessing the toxicity of organo-phosphorus compounds, question whether there will not be evolved compounds toxic to insects but harmless to mammals. There are already hopeful signs that work towards this ideal is being carried out. Johnson and co-workers (1952) have described the preparation of a new series of dithiophosphate esters whose basic toxicity relative to Parathion was discussed. These compounds were generally one-quarter to a third as active on insects as Parathion, but 5 to 100 times less toxic to mice. One compound, Malathon, has a toxicity about 1 per cent. of that of Parathion but it is 25 to 30 per cent. as toxic to many insects.

Summary

1. The toxicity and physiological action of the dinitro and organo-phosphorus compounds are reviewed.

2. Results of toxicity trials on experimental animals and swine are reported.

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CLINICAL COMMUNICATION

RECOVERY IN A CAT FOLLOWING HYSTERECTOMY, POST-OPERATIVE PROLAPSE AND RESECTION OF THE ILEUM

G. T. WILKINSON
Norwich

Subject.—Ten-year-old ginger and white, short-haired queen.

The animal was brought in for examination on May 5th, 1953, with the history that she had been in labour since April 30th, but with no result. Abdominal palpation revealed the presence of one dead kitten but the vagina was closed to internal examination. There was no vaginal discharge and the cat was in fairly good condition apart from some dehydration. Surgery was advocated and complete ovaro-hysterectomy was performed in the usual manner and with apparent success.

One week later the cat was brought back to the surgery for removal of the sutures and it was then noticed that there was a small herniation of the abdominal viscera due to breakdown of the internal wound. The external wound having completely healed, however, it was deemed safe to remove the sutures and this was done. The owner then took the cat home, a distance of six miles, and two hours later rang up to say that the animal's insides were coming out. A further hour and a half elapsed before the cat could be brought into the surgery.

Examination showed a very shocked animal with prolapse and exposure of stomach, spleen, a large section of ileum and omentum. The animal was anaesthetised and the exposed viscera washed as completely as possible with warm sterile water. During the more careful examination of the viscera it was found that the cat had clawed the mesentery away from about 18 inches of ileum, thus depriving it of its blood supply. The central part of the affected portion was already blanched and ischaemic.

The other viscera, liberally anointed with intramammary procaine penicillin, were returned to the abdominal cavity and resection of the affected portion of the ileum was performed. A lateral anastomosis of the resected ileum was then made, using 4/0 chromic catgut; omentum was wrapped around the join, the whole then being returned to the abdomen and the abdominal wound closed with nylon. Half a c.c. of "Rephrin" (Bayer) was injected intramuscularly and also 1 c.c. of "Mylipen."

There was some vomiting during the immediate post-operative period but this subsided within 12 hours. One c.c. of "Mylipen" was injected daily for 72 hours but no rise in temperature was noted and this was discontinued. No food or liquid was taken voluntarily for 72 hours and then the animal took some milk and glucose. Subsequent recovery was continuous and rapid, a bowel evacuation occurring on the fourth post-operative day and the animal becoming more lively each day.

Breakdown of the internal wound occurred again on the fifth day, so the external sutures were left in indefinitely.

The case is recorded to demonstrate the ability of the cat to withstand a very severe degree of surgical interference in the abdomen. When the age of this particular animal is taken into consideration it is remarkable that recovery did occur.

ABSTRACTS

Replacement of Femoral Head by Stainless Steel Prosthesis*

In these two papers the writer describes the experimental removal of the head of the femur and its replacement by a stainless steel prosthesis. This prosthesis consists of a head and a shaft which is turned from one piece of 18 by 8 stainless steel. It is made in various sizes and then polished and treated to produce a smooth surface.

Operative technique is as follows: the skin incision is made over the great trochanter and the biceps and tensor fasciae latae are separated at their junction and reflected. Then the superficial, middle, and deep gluteal muscles are separated in turn and severed at their insertion into the trochanter, thus exposing the dorsal rim of the acetabulum. The joint capsule is next cut and then the ligamentum teres—allowing complete luxation of the femoral head. This head may now be measured and a prosthesis of the correct size selected (an approximate idea of the size may be obtained from X-ray negatives). The bony head is severed at right angles to the neck, and a hole is drilled in the femur at the correct angle to take the shaft of the prosthesis. This shaft is inserted and tapped into place and the head is then seated in the acetabulum. In closing the wound the joint capsule is sutured first and then the severed gluteal muscles sutured in turn; the middle gluteal muscle being anchored by a suture which is passed through a hole drilled in the lip of the great trochanter. The superficial layers and skin are closed in the usual manner, and the leg is bandaged in the flexed position to prevent weight bearing for at least five days.

The author records having performed the operation in seven dogs and nine cats and gives case histories of completely successful results in three dogs and one cat—including one case in which a subsequent luxation of the prosthesis was successfully reduced.

It is claimed that the pathological conditions which are amenable to this procedure are osteo-arthritis, congenital sub-luxations, fractures of the femoral head or neck, traumatic dislocations that do not respond to standard procedures and fractures of the pelvis involving the acetabulum. [It is difficult to understand how the treatment of the last two conditions would be aided by the destruction of the intact femoral head and its replacement by an artificial prosthesis.—*Abstractor.*]

S. W. D.

* **I.—A Surgical Approach to the Coxofemoral Joint of Dogs; II.—The Experimental Use of Stainless Steel Femoral Head Prostheses in Normal Dogs and Cats.** Brown, R. E. (1953). *N. Amer. Vet.* **34.** 420–428.

* * * * *

An Anti-tuberculous Substance in Tuberculous Organs*

An inhibitory agent capable of preventing the growth of tubercle bacilli is described. It was isolated from tuberculous bovine lymph glands and from the spleen and liver of infected guinea-pigs, by reducing these tissues to a pulp, suspending in Sauton medium and filtering.

The inhibitory power of such extracts was demonstrated by placing 1 mg. of culture of a bovine strain in contact at 37° C. for 72 hours and then injecting this suspension into guinea-pigs. After six weeks, saline control suspensions of bacilli had produced generalised tuberculosis in

* **An Anti-tuberculous Substance in Tuberculous Organs.** Soltys, M. A. (1953). *J. comp. Path.* **63.** 147.

control animals but no evidence of infection in those injected with treated organisms.

It was shown that the extract was active against organisms within infected tissues. By washing with saline organisms which had been in contact with extract for six days, it was found that they were still viable in small numbers. This observation together with the fact that the extract tends to agglutinate bacilli into large clumps suggests to the author that the substance present in tuberculous tissues is some form of antibody.

S. J. E.

* * * * *

ACTH in Parturient Paresis of Cows*

ACTH was given to four cows with parturient paresis; 0·6 mg. per kg. completely cured them although injections of calcium, magnesium, phosphorus, glucose, etc., had failed. After ACTH the serum Ca increased, serum Mg was unaffected, serum P did not rise, K decreased and Na showed a slight rise. Diarrhoea was produced and the appetite returned soon after the injection. The eosinophils were reduced in prolonged paresis; this was unaffected by ACTH.

F. A.

* **Effect of ACTH on Mineral Levels as well as on Protein Fractions and on Eosinophil Count in the Blood of Cows during Paresis.** Westermark, H. W. (1953). *Proc. Int. Vet. Cong.*, Stockholm. 1. 540.

* * * * *

Uninterrupted Protection of the Foal against Tetanus*

The newborn foal may be protected from immediate risks of tetanus, particularly through the umbilicus, by the active immunisation of the dam during the last few weeks of her pregnancy. This immunity is passively transferred to the foal, principally through the colostrum and to a minor degree via the placenta. The immunity so conferred disappears almost completely by three months of age.

Thus there is a need for the creation of some form of active immunity in the foal at four to six weeks, but the authors stress the difficulty of stimulating such immunity in the young animal.

It was found that these difficulties could be overcome by the injection of tetanus anatoxin precipitated with alum in adult doses at six weeks of age. The vaccination should be repeated a year afterwards. This procedure coupled with vaccination of the dams gives the foal uninterrupted protection.

D. L. H.

* **Uninterrupted Specific Prophylaxis against Tetanus carried out on the Horse from Birth** (Trans. title). Lemetayer, E., *et al.* (1953). *Proc. Int. Vet. Cong.*, Stockholm. 1. 57–61.

* * * * *

Migram: A Disease of Sheep on the Romney Marsh*

A condition found in sheep and locally called migram is described. The incidence is principally associated with a deficiency of moisture in the diet (which, in the cases studied, was unsupplemented grazing on mainly natural rye grass, "squirrel tail" and wild white clover on a subsoil of high potash and medium phosphate) together with the ingestion of salt water from sea-water ditches during hot dry weather. Mild cases also occurred during dry winters.

The predominating symptoms are nervous and associated with the gait, and these are fully and very clearly described. The author differentiates the symptoms from those of salt poisoning and the nervous symptoms of other diseases. Facts are given to support a tentative diagnosis of dehydration and an experiment carried out by the author leads to his hypothesis that dry conditions, with or without hot weather, are essential predisposing causes. The condition is cured by providing fresh water.

J. C. V. H.

* **Migram : A Disease of Sheep on the Romney Marsh.** Chesney, R. W. L. (1953). *Brit. vet. J.* 109. 257–268.

REPORT

THE IMPROVEMENT OF CATTLE IN BRITISH COLONIAL TERRITORIES IN AFRICA*

Let it be said at once that anyone interested in the improvement of cattle in our African colonies should make a point of obtaining a copy of this publication, for nothing like it has hitherto appeared and the joint authors are to be heartily congratulated on the production of what undoubtedly will be looked upon as a monumental work.

The extent of the ground covered and the breadth of view taken are most refreshing and certainly derive from the fact that the authors, one a veterinary officer and the other an agricultural officer, are both experienced administrators in the Colonial Service and are, therefore, well able to appreciate the great difficulties involved in any attempt to improve the livestock in these under-developed countries.

That such attempts should be made, and repeated, is manifest from the figures of cattle populations *vis-à-vis* human populations given in the report. In several cases the cattle population is 50 per cent. of the human population, and in the case of Kenya it actually exceeds the human population. As the report states, livestock represent to many African stock-owners, if not their most valuable, at any rate one of their most valuable assets. They supply personal prestige, milk, meat, draught power, manure and hides and skins for sale for cash and for use as clothes, thongs and ropes, butter-fat and ghee for cooking; and in spite of the low value placed on these articles, had there been time to carry out a comparative valuation, it would probably have been found that in Colonial Africa, as in some other Commonwealth countries with a similar ecology, the total value of its livestock products exceeds the value of its cash crops.

The authors point out that the fundamental cause of the deterioration of livestock in any territory is their inability to adapt themselves to their environment. In Europe and the U.S.A. the required improvement can be brought about by the application of scientific principles of breeding, but in Africa much improvement can be effected by such simple methods as the provision of an efficient water supply, limitation of the number of stock, control of disease, etc., and in fact these items must have a prior claim.

They go on to state, what every veterinarian who has worked in the tropics knows full well, that a study of ecological conditions must be an essential background to any scheme for livestock improvement.

With a view to the transfer of productive animals from one area to another with similar ecological conditions, a plea is made for the preparation of vegetation and climatic

* The Improvement of Cattle in British Colonial Territories in Africa. By D. E. Faulkner and J. D. Brown, Colonial Advisory Council of Agriculture, Animal Health and Forestry, Publication No. 3, 1953. Price 10s. 6d.

maps of the different Colonial territories in Africa, and this might be extended to include the territories of other nationals in Africa and even outside Africa. There is plenty of evidence in this report to show the advantages of importing breeds for grading work from countries such as India, having similar ecological conditions to parts of Africa, as compared with the importation of European breeds.

The statement is made that disease is still the greatest single limiting factor to improvement and special reference is made to the widespread prevalence of trypanosomiasis and the need for animals able to withstand its ravages. Rinderpest is now under control, but other conditions still of importance are the tick-borne diseases, bovine pleuropneumonia and cervico-vaginitis, the last-mentioned being especially prevalent in European and grade cattle. It is pointed out that apart from the important contribution which accrues from the successful treatment and prevention of disease, advantage can be taken of the opportunity offered at the same time to introduce other methods to improve the environmental conditions of the herd under observation. As the report truly remarks, in some territories it is only the officials responsible for these duties, *i.e.*, veterinarians, who are in frequent contact with the people.

Regarding nutrition, it is pointed out that the problem is largely a quantitative one. No fodder crops are grown, no conservation of grass is practised, and the grass, even when it is available, is of poor quality. In the spring, the most favourable time of the year, the average protein content is only 7⅛ per cent., while in the dry season this may drop to as low as 2½ per cent. This leads to a reduction in the milk supply and irregular breeding and we then see the picture, all too common in tropical countries, of large herds of low-producing animals, which accentuate and may even be responsible for the evils of soil erosion. The irony of the situation is that while there is a constant clamour for better disease control, this same control is to some extent responsible for the large size of these unproductive herds. No better illustration than this could be offered to show the importance of encouraging the veterinarian working in the tropics to take a wide view of his subject and not confine himself merely to disease control.

When discussing the different systems of farming in vogue in the territories under review, considerable attention is given to the problem of the Fulani and other nomadic cattle-owning tribes. As regards the Fulani, the challenging statement is made that until integration of these nomadic cattle people with the non-cattle-owning peasants takes place, little improvement in the cattle of West Africa can be expected. The authors would, no doubt, agree that such integration would lead to improvement both in livestock and crops, but, as they readily admit, the process of settling these nomads must be a very gradual one, and it is likely to be many years before full success can be claimed.

In the interim, there seems to be no valid reason why attempts should not be made gradually to bring over such excellent stockmen as the Fulani are to a more settled existence, provide them with marketing facilities and encourage them to part with their surplus stock to satisfy the ever-increasing demand which exists for meat.

There is general agreement on the necessity for determining the productive potential of the different types of African stock, and it is said that the results so far achieved, which have often been carried out under difficult conditions, are very encouraging and indicate considerable potentialities of many African types. This work, however, will have to be taken much farther if the requirements of the territories, which are said to be for a dual-purpose and often a triple-purpose animal, are to be fulfilled. The demand for meat is universal, draught is required for the successful introduction of mixed farming schemes, and in some areas in or near large towns the emphasis is on milk.

The different methods by which cattle may be improved in these under-developed areas are discussed and generally speaking it has been decided to recommend the slow but sure way of selection within the indigenous breeds. A number of European breeds have been successfully introduced into the Highlands of Kenya and a few other special tracts, where the provision of more milk is the chief consideration, but a very difficult problem has arisen through the filtration of some of the progeny of these animals and cross-bred stock into villages surrounding these special tracts. By the acquisition of such animals the immediate cash return to the villagers is increased, but under the system of management existing in these villages, deterioration of the stock soon sets in and undoubtedly the last condition of these villages will be worse than the first. Obviously, if the importation of European animals is to continue, the strictest control over the distribution of their progeny must be exercised.

A much more successful importation of foreign stock took place in 1939, when the Government of India of the time co-operated in the transfer of nine Sahiwal bulls to Kenya and it is held to be most unfortunate that further importations have not been obtainable. Previous to this, importation of both Sahiwal and Red Sindhi bulls had taken place in some of the other East African colonies with success. The close relationship between these Indian Zebu breeds and some of the African Zebus is remarkable and obviously the Indian breeds, which have a similar ecological background and some of which have been markedly developed, particularly for milk production, in the last 40 years, should be the breeds of choice if any are required to accelerate the grading-up process amongst African Zebus.

Anyone familiar with the Indian breeds will at once be struck with the identical appearance of the Boran bull, whose photograph faces page 84 of the report, with many Sahiwal bulls which he will have seen, and the great resemblance between the Sokoto Gudali of Nigeria, the Kennana of the Sudan and the Hariana breed of India has been commented upon previously.

It appears that the focus of improvement in most areas is the Livestock Improvement Centre and quite rightly the point is made that it is very important to relate the policy of each centre to the requirements of the area it is designed to serve. Generally speaking, the approach should be first disease control, then prevention of overstocking, provision of marketing facilities, control of grazing and improvement of water supplies. The area may then be said to be ready to receive improved stock from the centre, and in this connection it is pleasant to read of the success of such a policy followed at the Baraton Livestock Improvement Centre in the Nandi Reserve, Kenya. It is said that the pride of the Nandi in their stock is evident and similar happy results have also been obtained in the Buganda area of Uganda.

The question of progeny testing is discussed, but it is pointed out that an African bull, or for that matter an Indian bull, may be seven or eight years old before his first daughters complete their first lactation and it has been observed previously by workers both in Africa and India that a Zebu heifer's first lactation may be unreliable, owing to her disinclination to let down her milk. The authors, therefore, consider it better to rely on a bull's ancestors and collateral relations, rather than on any dam-daughter comparisons.

It is unfortunate that the help of A.I. cannot be enlisted yet to accelerate progress in grading-up Zebu stock for two reasons. The heat period in Zebu females is very short, about two and a half hours and sometimes less, while Zebu bulls have so far proved rather intractable to train in this method.

The preceding paragraphs are an attempt to pin-point the most important subjects dealt with in this most interesting and comprehensive report, which it is hoped will be accepted and acted upon without delay. One important point, however, remains and this is referred to by the authors in their covering letter to the report. They state that, in their view, animal breeding investigations and research in a number of dependencies have been gravely hindered by lack of continuity of the breeding policy or by the absence of a properly thought-out policy. No further reference to this subject is made in the report, but it is surely of outstanding importance that arrangements should be made to prevent the continuation of such a state of affairs. It must be true to say that this lack of continuity or lack of any policy at all has been the greatest of all bugbears in the past amongst those attempting livestock improvement in many tropical parts of the old British Empire.

The time surely has come when those responsible for administering this vital subject of livestock improvement in our African colonies should take a leaf out of the book of those nationals, both within and outside the Commonwealth, which have set up separate comprehensive departments for livestock improvement, capable of devising and carrying through a livestock policy of a permanent nature. Such a department need not in any way clash with the work of the existing Agricultural Department: in fact, its work would be complementary. The stated aim of most Agricultural Departments in the Colonial African Territories is to introduce a system of mixed farming, but they admit to being hampered by the lack of suitable animals. On this score alone, therefore, a good case can be made out for setting up a department charged with the responsibility, *inter alia*, of evolving and multiplying animals of a suitable type or types for use in these projected mixed farming operations.

F. W.

REVIEW

[Calf Rearing. Bulletin No. 10 of the Ministry of Agriculture and Fisheries. Third edition, May, 1953. Pp. iv and 28. H.M.S.O., price 1s. 3d.]

The third edition of this well-known bulletin has again been revised by Mr. James Mackintosh and contains a contribution from the Veterinary Laboratory, Weybridge, on digestive and other troubles and on the subject of dishorning. Although dated May, 1953, the work was not actually published until some months later, and while derationing is foreshadowed in the text it seems unfortunate that further revision could not have been made at the proof stage in order to bring the work a little more up to date at the time of issue.

In other respects the text has been carefully revised and altogether there is much of value to the farmer and veterinarian. The author has, perhaps wisely, refrained from making any allusions to the recent work in this country on cod-liver oil and muscular dystrophy in calves, but members of the profession who listened to Dr. K. L. Blaxter at the 1953 B.V.A. Congress may wonder at the complete lack of reference to his findings. In the section on rearing calves free from disease the information on husk seems out of date and fails to take important post-war observations into account.

ROYAL COLLEGE OF VETERINARY SURGEONS

ANNUAL GENERAL MEETING IN EDINBURGH*

The 110th Annual General Meeting of the Royal College of Veterinary Surgeons was held at the Royal (Dick) School of Veterinary Studies, Summerhall, Edinburgh, on May 27th, 1953, with the President, Professor J. G. Wright, D.Sc., M.V.Sc., F.R.C.V.S., in the chair.

Among the apologies for absence intimated by the Registrar, Mr. W. G. R. Oates, was that of Captain J. W. Procter, who, it was stated, was extremely ill and desired that his resignation as a member of the Council be accepted, to take immediate effect. The PRESIDENT said that members would be grieved to learn of Captain Procter's illness and the necessity to resign from the Council. On the suggestion of Captain T. M. MITCHELL, supported by the President, it was agreed to send to Captain Procter a vote of thanks for the services he had rendered for a number of years.

It was further moved from the chair that the Council should send a letter of condolence to their esteemed colleague Professor Wooldridge. He had been very, very ill, the President said, but was well on the way to recovery so far as his systemic illness was concerned, though his eyes still gave cause for concern. It was agreed to send condolences and regrets that Professor Wooldridge had been unable to be present.

MEMBERSHIP OF THE COUNCIL

The REGISTRAR intimated the receipt of a letter from the Privy Council informing the Royal College that their Lordships had been pleased to appoint the following nominees: Sir Thomas Dalling, Captain J. A. L. Duncan, Mr. J. N. Ritchie and Captain T. F. Peart.

The PRESIDENT declared the nominees of the Privy Council appointed.

It was intimated that the University of Glasgow had reappointed Professor R. C. Garry and Professor W. L. Weipers.

The University of Edinburgh had reappointed Professor G. F. Boddie.

The University of Bristol had reappointed Professor F. Blakemore.

The University of Liverpool had reappointed Professor R. E. Glover and Professor J. G. Wright.

The University of London appointed Dr. C. F. Harris in place of Mr. Philip Mitchiner, deceased, for the remainder of the period of service; Dr. Harris was then reappointed for a further period of four years; that is, until the Annual General Meeting in 1957.

The PRESIDENT declared these nominees appointed.

The REGISTRAR intimated the results of a ballot for membership of the Council, as received from the chartered accountants of the Royal College. There were 11 candidates for six vacancies. The names and votes were: Montgomerie, R. F., 1,282; Pugh, L. P., 1,073; Anderson, L. G., 1,014; Mitchell, T. M., 986; Lovell, R., 909; Sumner, H., 856; White, J. B., 660; Joshua, J. O., 580; Rowlands, W. T., 544; Uvarov, O., 381; Halpin, F. B., 160. [These results were announced in our columns at the time.—*Editor.*]

* The delay in publication of these proceedings is to be explained by the fact that whereas, in recent years, insertion of the report of the Annual General Meeting of the Royal College has not been made in *The Veterinary Record* because, in essence, it is circulated to every member of the College in due course, at its November meeting the Editorial Committee decided that the practice of inserting the report be renewed, more particularly in view of the President's observations on the increase in the annual fee, which subject has featured largely in our correspondence columns of late.—*Editor.*

The total number of voting papers received was 1,396, of which 146 were received from overseas members. There were in addition 16 voting papers declared invalid.

The Registrar said that before the President formally nominated members of the Council it was necessary to explain that there were two further vacancies, the first caused by the appointment of Mr. J. N. Ritchie as a Privy Council representative and the second by the resignation of Captain Procter; so that there would be eight vacancies. The first six would be for a period of four years; the seventh, in place of Mr. J. N. Ritchie, would be for two years; and the eighth, in place of Captain Procter, would be for one year.

The President declared the following persons elected members of the Council for a period of four years: Dr. R. F. Montgomerie, Professor L. P. Pugh, Mr. L. G. Anderson, Captain T. M. Mitchell, Dr. R. Lovell and Mr. H. Sumner. He declared Mr. J. B. White elected for a period of two years and Miss J. O. Joshua for a period of one year.

Annual Report: Proposed Increase in Annual Fee

When the annual report came up for consideration, Captain R. N. Phillips took up the matter of the proposed increase of the annual fee. It was with fear and trepidation, he said, that he rose to speak at the annual meeting. The annual report was very comprehensive and showed the amount of work put in by the Council, but he had come 400 miles because of two items it contained. He could not help feeling that a deficit could have been anticipated and the membership fee raised a few years ago, since there was no question of using their bank reserves. He felt he was supported in this by local practitioners at home. He was even more disappointed to see as part of the increase law expenses, presumably due to the 1948 Act, and that people on the Supplementary Veterinary Register did not pay the same as themselves. Moreover, there was not a registration fee for them. He had analysed the balance sheet carefully and had estimated that if membership fees for veterinary members had been put up to three guineas, provided income and expenditure remained static they would have received over £7,000 last year and their overdraft could have been written off. He proposed the amendment of the figures on page 13 of the report to read 1 (*a*) £3 3s.; (*b*) £3 3s.; and that an extra paragraph be added to the effect that the annual fee would be reduced to £2 2s. when the deficit had been removed. This was seconded by Mr. G. M. G. Oliver.

The President said he would be required, in the first instance, to reply to the remarks which Captain Phillips appended to his amendment.

He had pointed out that there was an annual loss of some £6,500, added to an additional loss; but the reason for that loss was not solely the rising cost of prices, it was the rapidly increasing decline in income which resulted from the Veterinary Surgeons Act in relation to examination fees. The biggest item of income to the College had always been examination fees. With the introduction of the Veterinary Surgeons Act the examination of students became the responsibility of the University colleges, and the Royal College no longer received fees for the examination of its students.

The Royal College had been passing through a transitional stage. They now examined no students for the University of Liverpool; no students for the University of Bristol; a few annually for the University of Glasgow. They examined the whole of the students for the Veterinary College of Ireland; and the larger proportion of students for the schools of London and Edinburgh. While their income from student examination fees was falling greatly, their payments to examiners were not falling by anything like the same extent. Examination fees and examiners' payment were not a matter for balance in the past. The income of the Royal College had been largely from examination fees and now they had to a large extent ceased.

When the Veterinary Surgeons Act was only a Bill the Royal College were well aware that the passing of that Bill into law would mean that they would rapidly fall into a parlous financial state, and that was the reason provision was made whereby the annual fee of members could be increased to as much as £5 5s. The cost of running the College had become greatly increased, again as a result of the Veterinary Surgeons Act. The establishment of the Supplementary Veterinary Register had been very expensive. The conduct of disciplinary affairs was very much more costly than under the old conditions when the whole Council acted as the registration committee.

The penalties of striking a person's name from the register were infinitely greater to-day than prior to the Act. If a name were struck off the register now it completely debarred a person from practising his profession. The Act of Parliament laid down very definite procedure for carrying out the affairs of the Disciplinary Committee.

Quite apart from the fact that costs were rising, a great deal of work at headquarters had meant that more staff had had to be engaged, and he expressed the opinion that they had not yet reached the ceiling in staff. Very shortly, he thought, they would have to increase their senior staff at the College if they were to get through the work. The Council thought that by increasing the annual fee to one of £4 4s. they would become solvent again. They felt it was improper to try to run the affairs of the profession with an income less than that which would accrue from a £4 4s. fee.

Replying on a matter of fact to Captain Phillips' statement, the President said that the annual fee of £1 1s. for persons on the Supplementary Veterinary Register was a statutory fee laid down by the Veterinary Surgeons Act. They did pay an initial registration fee of £1 1s.

The President moved that the Council's recommendations be adopted, and this was duly seconded.

There were no speakers to the amendment and the matter was put to the vote, 23 being in favour of the amendment and 33 against.

On the result being declared, the President said that the Registrar had asked him to remind the meeting that there was provision whereby fees were reviewed from year to year and could be reduced.

The report as circulated was adopted on the motion of Professor R. E. Glover and seconded by Mr. J. N. Ritchie.

In connection with the nomination of a member of Council from the Republic of Ireland, the receipt was reported from the Registrar of the Veterinary Council of the Republic of Ireland of the election (unconfirmed) of Professor P. E. Mullaney. This had not been confirmed until the day before the annual meeting. The President declared Professor Mullaney appointed.

In closing the meeting, the President expressed thanks to the University of Edinburgh and the authorities of the Royal (Dick) School of Veterinary Studies, firstly, for the invitation to hold the Annual General Meeting in Edinburgh, and secondly, for providing for them the beautiful setting in which to hold the meeting.

Clanville Lady Butterfly the Eighth, a pedigree dairy Shorthorn, has set up a new record milk yield for her class for a 305-day lactation by giving 25,415¼ lb. of milk (about 2,541 gallons). The previous highest 305-day yield in the class was 25,390 lb.

QUESTIONS IN PARLIAMENT

Abattoirs

Mr. J. Johnson (November 16th) asked the Minister of Food what abattoirs have been built since 1945; what are being built now; and what is the population served by each of these, respectively.

Major Lloyd George: Five have been built by the Government, at Guildford, Fareham, Canterbury, Grimsby and Swindon, and one by the local authority at Plymouth. Two are being built by the Government, at Salisbury and Wimborne, and building will shortly be started on another at Sunderland. Under the existing Meat Control Scheme these slaughterhouses are serving or are intended to serve the following approximate populations:—

Guildford	200,000
Fareham	500,000
Grimsby	175,000
Swindon	100,000
Plymouth	208,000
Salisbury	100,000
Wimborne	325,000
Sunderland	300,000

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Kilmarnock Slaughterhouse

Mr. Ross (November 17th) asked the Secretary of State for Scotland if he is aware that conditions in the Kilmarnock slaughterhouse are causing concern; and when the local authority will be permitted to provide the modern slaughterhouse premises necessary in the interests of food hygiene and public health.

Commander Galbraith: Minor works have recently been carried out to improve conditions at this slaughterhouse. The question of major works will depend upon the recommendations of the Scottish Interdepartmental Committee on Slaughterhouses who have been asked to consider an order of priority for new works to fit in with their proposals for a siting plan for the whole country.

Mr. Ross: Despite the minor repairs that have been carried out, is the Under-Secretary of State aware that the sanitary inspector recently described the conditions of this slaughterhouse as completely unsatisfactory and out of date and subject to periodic flooding, and that this danger was underlined by events in Kilmarnock last week? Is the hon. Gentleman further aware that for at least six years I have been asking this question of various Secretaries of State for Scotland, and that there is still no hope of progress? Can he hold out any hope that Kilmarnock Town Council will be able to provide the abattoir that is required?

Commander Galbraith: I think we must wait until we have the report of the committee.

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VACCINATION AGAINST SWINE FEVER

In the House of Commons on Thursday of last week Sir Thomas Dugdale, Minister of Agriculture, in a written reply to Mr. Aitken said that the swine fever restrictions in Norfolk, Suffolk and Essex were about to be removed.

In another written reply to Sir Leonard Ropner he announced that a Registered Vaccinated Herds Scheme would be introduced on December 15th. [This announcement is dealt with at length in our Notes and News columns.—*Editor*].

Discussion on Dr. K. L. Blaxter's paper "Muscular Dystrophy" (*Vet. Rec.* **65.** 838): we regret that the contribution to the discussion, attributed to Mr. E. J. Hughes (Birmingham), was in fact made by Mr. D. L. Hughes (Thurgarton): the word "familiar" also recorded on that page should read "familial." These mistakes arose from an error in the reporter's note.

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Erratum.—R.C.V.S. Pharmacology Examination, November, 1953 (*Vet. Rec.* **65.** 852): the omission of the name Williamson, D. C., from the London list, through a printer's error, is regretted.

NOTES AND NEWS

Diary of Events

Dec. 3rd.—Meeting of the Central Division, B.V.A., at the Royal Veterinary College, N.W.1, 5.30 p.m.

Dec. 3rd.—General Meeting of the East Midland Division, B.V.A., at the School of Agriculture, Sutton Bonington, 2.15 p.m.

Dec. 4th.—Annual Dinner and Dance of the North Wales Division at Llandudno (St. George's Hotel), 7 p.m. for 7.30 p.m.

Dec. 4th.—Quarterly General Meeting of the South Wales Division, B.V.A., at Cardiff (Park Hotel), 11.30 a.m.

Dec. 9th.—Meeting of the Editorial Committee, B.V.A., at 36, Gordon Square, W.C.1, 2.30 p.m.

Dec. 10th.—Meeting of the Essex Veterinary Society, at the Essex Institute of Agriculture, Writtle, 7.30 p.m.

Dec. 12th.—Meeting of the Biochemical Society, in the London Hospital Medical College, Turner Street, E.1, 11 a.m.

Dec. 16th.—Meeting of the Section of Comparative Medicine, Royal Society of Medicine, to be held jointly with the Section of Ophthalmology, at 1, Wimpole Street, W.1, 5 p.m.

Dec. 17th.—Annual Dance, Dumfries and Galloway Branch of the V.Y.B.F. Ladies' Guild, at the Cairndale Hotel, Dumfries.

Dec. 18th.—Meeting of the Midland Counties Division, B.V.A., at the Birmingham Medical Institute, 154, Great Charles Street, 2.30 p.m.

R.C.V.S. Membership Examinations

Dec. 10th.—M.R.C.V.S. Written Examinations.
Dec. 11th.—M.R.C.V.S. Written Examinations.
Dec. 14th.—M.R.C.V.S. Oral and Practicals commence (Panels "A" and "B").

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Change of Date of Next Meetings of Council and Committees, B.V.A.

Owing to the fact that headquarters will be moving to 7, Mansfield Street just before Christmas the meetings fixed for early January (6th, 7th and 8th) have now been postponed until Wednesday, Thursday and Friday, January 20th, 21st and 22nd, 1954.

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SWINE FEVER—REGISTERED VACCINATED HERD SCHEME

Announcement of Introduction

In reply to a question in the House of Commons on Thursday of last week, the Minister of Agriculture and Fisheries, Sir Thomas Dugdale, announced the introduction next month of a scheme for securing the more extensive and regular use of swine fever crystal violet vaccine. The Minister said:—

"A Registered Vaccinated Herds Scheme will be introduced on December 15th. It will enable pig breeders to have their pigs regularly vaccinated with crystal violet vaccine by veterinary surgeons at standard fees. Breeders participating in the scheme will be entitled to describe their stock as a 'Registered Vaccinated Herd.' The aim of the scheme is to produce a continuing large supply of pigs immunised against swine fever, and so greatly reduce the losses caused to pig keepers by this disease. Particulars of the scheme will be in the hands of all veterinary surgeons likely to be interested by the end of this month. Pig breeders should then ask their veterinary surgeons for details."

The scheme, which has been drawn up in consultation with the British Veterinary Association and the National Farmers' Unions of England and Wales and Scotland, will be reviewed in a year's time. It is open to all pig breeders. Some breeders at present vaccinate their own pigs under the general advice of their veterinary surgeons. These particular breeders, only, will be permitted to continue this practice within the scheme, but any other breeders who, in future, may make similar arrangements with their veterinary surgeons will not be eligible to participate in the scheme.

Losses in Recent Years

This country is seldom completely free from swine fever, which not only spreads from pig to pig and from herd to herd in the course of ordinary trade, marketing and movement of pigs, but may also be introduced to healthy pigs by contaminated swill. The following figures show the losses of pigs from swine fever from 1938 to 1953.

Year	Number of outbreaks	Number of pigs lost	Percentage of all pigs on infected premises
1938	951	26,422	42
1939	3,286	84,588	41
1940	5,019	106,954	37
1941	1,088	15,063	26
1942	451	7,469	21
1943	547	7,149	27
1944	1,449	20,945	35
1945	928	15,031	31
1946	347	5,622	31
1947	37	284	20
1948	27	153	17
1949	5	31	8
1950	430	5,177	23
1951	1,343	21,691	28
1952	891	13,380	24
1953 (to 15/11/53)	2,509	Not yet available	Not yet available

The Scheme

As a protection against this ever-present threat of swine fever which, in any of its forms, may cause heavy financial losses, pig breeders are advised to have all their pigs vaccinated with crystal violet vaccine under the scheme which is being introduced by the Ministry.

This scheme, which will come into operation on December 15th, is open to all pig breeders and provides for the vaccination of the entire herd by a veterinary surgeon at standard charges as follows:—

A turn-out fee of 7s. 6d. plus a flat rate fee of 2s. per pig up to 24 pigs and 1s. 6d. per pig thereafter.

The vaccine to be used under this scheme will be supplied by the Ministry to participating veterinary surgeons at 2s. 3d. for a dose of 5 c.c. (for a small pig) and 4s. 6d. for a dose of 10 c.c. (for a large pig). These will be the amounts pig breeders will be charged for the vaccine by veterinary surgeons. When the herd has been certified vaccinated it is registered at the Ministry and a number allotted. The breeder is then entitled to describe his herd as a Registered Vaccinated Herd.

Full particulars of the scheme will be available after November 30th from veterinary surgeons or from any of the Ministry's Animal Health Divisional Offices.

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Swine Fever (Infected Areas) Order Revoked

The Minister of Agriculture has made an Order revoking the Swine Fever (Infected Areas) Order, 1953 which prescribed that in certain specified areas no sale of swine should be held in any market, fairground or saleyard unless authorised by the Local Authority. Only fat swine for immediate slaughter could be included in such sales. The movement of swine into, out of and within the areas was also regulated.

The Swine Fever (Infected Areas) (Amendment) Order had already limited the restrictions to the area mentioned in Part III of the First Schedule to the original Order.

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PERSONAL

Agricultural Research Council Appointment

The Agricultural Research Council announce that Mr. R. Scarisbrick, M.A., PH.D., M.R.C.V.S., A.R.I.C., has been appointed to an additional post of Scientific Assistant to the Secretary of the Council. Dr. Scarisbrick, who will act as the Secretary's assistant in the fields of animal health and husbandry, will have the rank of Deputy Chief Scientific Officer. He will take up his new duties on January 1st, 1954.

Dr. Scarisbrick graduated in biochemistry and after a period of research work in Cambridge and at the Maudsley Hospital took his veterinary qualification at the University of Liverpool. His research experience includes work on the physiology of ruminants under the late Sir Joseph Barcroft and studies in pathological physiology in the former Institute of Animal Pathology, Cambridge. Since 1949 Dr. Scarisbrick has held the appointment of Lecturer in Animal Pathology in the University of Cambridge School of Veterinary Medicine.

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Retirements from the Ministry's Veterinary Staff in Scotland

"The whole story of tuberculin testing of dairy and other cattle in Great Britain had its first chapter of real progress in the county of Ayr. Thus," observes *Farming News* in its issue of November 20th, "there is historical interest in the announcement that Captain Quintin A. Stewart, O.B.E., M.R.C.V.S., the Divisional Veterinary Officer of the Ministry at Ayr, is retiring at the end of the year.

"Another prominent figure on the Ministry's Veterinary Staff in Scotland, Captain William Watt, M.R.C.V.S., the Divisional Officer at Stirling, is due to retire about the same date. Both of these officers have had the satisfaction of seeing the areas for which they are responsible in the West of Scotland achieve progress right up to the 100 per cent. clearance.

"Ayrshire breeders will recall Captain Stewart's predecessor, the late Major Douglas, who was County Veterinary Officer for Ayr before these officials were taken under the wing of the Ministry. Major Douglas's pioneering success was rewarded by his promotion as a Deputy Chief in London before he retired to Blairgowrie."

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Veterinary Field Staff.—Mr. F. J. Hill, M.R.C.V.S., D.V.S.M., is now stationed at Gloucester as Divisional Veterinary Officer in charge.

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Milk Marketing Board.—The Milk Marketing Board have appointed Mr. H. Cooke to succeed the late Mr. R. A. Pepperall as secretary to the board.

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Births.—Pinniger.—On November 10th, 1953, at Studland, to Odette, wife of Roger S. Pinniger, a daughter (Fawnia), sister for Mark.

Scurfield.—On November 16th, 1953, at Heather View, Etching Hill, Rugeley, Staffs, to Jennifer Scurfield, M.R.C.V.S., and Robert, a daughter.

White.—On November 17th, 1953, at Plymouth, to Norah, wife of J. A. White, B.Sc., M.R.C.V.S., a daughter, Joanna.

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Death.—Gresham.—On November 8th, 1953, at New Balderton, Newark, Notts, Mrs. F. B. Gresham, late of Ladybrand, South Africa, wife of Major F. B. Gresham, M.R.C.V.S.

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Hill Farming Research.—The Hill Farming Research Organisation has been set up by the Secretary of State for Scotland to take the place of the Hill Farm Research Committee, which went out of office last year. Mr. R. G. White, former Director of the Animal Breeding Research Organisation, is the Chairman.

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Private Members' Bills

On Wednesday of last week, Members who were successful in the ballot presented their Bills. These included the following, which were set down for second reading on the dates indicated:—

On *December 4th*: Lady Tweedsmuir (Aberdeen, South, C.).—Protection of Birds Bill.

On *January 29th*: Mr. Moyle (Oldbury and Halesowen, Lab.).—Slaughter of Animals (Amendment) Bill.

On *February 12th*: Viscountess Davidson (Hemel Hempstead, C.).—Protection of Animals (Anaesthetics) Bill. Mr. Remnant (Wokingham, C.).—Protection of Animals (Amendment) Bill.

On *March 12th*: Mr. Spearman (Scarborough and Whitby, C.).—Animals (Cruel Poisons) Bill.

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SALE OF VETERINARY MEDICINES TO BE CONTROLLED IN EIRE

In a message from Dublin, the Irish News Agency states that the introduction of legislation to control the sale of veterinary medicines to farmers and the initiation of a scheme to combat bovine tuberculosis were promised by Ireland's Minister for Agriculture, Mr. Tom Walsh, addressing members of the Veterinary Medical Association in Dublin on November 18th. "The uncontrolled sale of veterinary remedies to farmers has, in past years, given rise to some activities of an undersirable kind," the Minister said. "My department has in hand the preparation of legislation to deal with this matter."

In reference to tuberculosis, Mr. Walsh said that while Ireland was free from the more spectacular diseases such as foot-and-mouth, swine fever and fowl pest, bovine tuberculosis remained a big problem. "It is necessary to undertake measures to free our herds from this disease," he added. "To do this on a nationwide scale will take quite a number of years and cost many millions of pounds." The measures would start on a voluntary basis, but when a sufficient number of farmers was participating, eradication would become compulsory in all areas.

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Paris Conference on Myxomatosis

Under the chairmanship of its Director, Professor Ramon, the International Office of Epizootics held a Conference on myxomatosis in Paris on November 13th and 14th. It was attended by experts from the following countries which are affected or threatened by myxomatosis, namely, Germany, Austria, Belgium, Spain, France, Great Britain, Italy, Luxembourg and Netherlands. Mr. J. N. Ritchie, Chief Veterinary Officer, represented Great Britain.

Resolutions

After considering the progressive extension of the epizootic of myxomatosis and having examined the scientific, technical, economic and social aspects which are involved, the Conference recommended the following measures for its control:—

I—Measures of Protection:

(1) Prohibition of importation and traffic of live animals of susceptible species (including hares) coming from countries where the disease exists.

(2) The same prohibition applies to dead animals and products of animals of these species unless guaranteed by safeguards such as sterilisation, disinfection, etc.

(3) Notification of all new outbreaks of the disease.

II—Eradication Measures:

(1) Domestic animals: isolation, segregation, prohibition of movement into and out of infected places or areas, slaughter of infected and contact animals, destruction of carcases and disinfection.

(2) Wild rabbits (and possibly animals of other susceptible species): extermination in infected zones and destruction of carcases.

III—Special Measures:

(1) The Conference draws attention to the difficulty arising at the time of an epizootic from importations of animals belonging to species which may become infected and transmit the disease without showing symptoms.

(2) The Conference insists on the need for the distribution and use of pathogenic viruses, for experimental or other use, to be subject to the approval of the competent authorities.

(3) On the question of prevention of myxomatosis by vaccination, the Conference reiterates the resolution adopted by the XVth International Veterinary Congress which was held at Stockholm, August 9th to 15th, 1953, which is as follows:—

"The XVth International Veterinary Congress recommends that, when choosing a process of immunisation with a view to combating an infectious disease, preference is given to vaccines composed of germs or viruses killed or made inactive, so that they are totally inoffensive. Living germs or viruses, attenuated or not, should not be used unless no other immunising method of sufficient value exists.

"In that case, the so-called 'living' vaccines shall not be used generally unless a profound experimental study has proved the stable character of the viruses of which the vaccines are composed, and has precisely determined the risks which their use involves. The possession and the use of these vaccines should be reserved exclusively to veterinarians."

(4) The Conference recommends that research be pursued with a view to finding and preparing a vaccine entirely harmless and giving a high degree of lasting immunity.

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The Protection of Laboratory Rabbits

The Laboratory Animals Bureau has prepared the following memorandum for the information of those concerned with the measures that can be taken to protect laboratory rabbits against myxomatosis:—

Myxomatosis in Rabbits

Myxomatosis was reported among wild rabbits in Kent and Sussex during October, 1953. It had almost certainly come from the Continent, where the disease is now widespread. A Myxomatosis Advisory Committee has been set up by the Ministry of Agriculture and Fisheries, under the chairmanship of Lord Carrington, Joint Parliamentary Secretary. It will in due course present a report, but in the meantime the Laboratory Animals Bureau offers the following brief notes on the disease, and the steps which may be taken to protect laboratory rabbits.

Aetiology and Pathology.—Myxomatosis, a virus disease of rabbits, was first described by Sanarelli in 1898. It is enzootic in certain wild South American rabbits (*Sylvilagus* spp.), where it has a comparatively low mortality, but it is almost 100 per cent. fatal in European rabbits (*Oryctolagus cuniculus*). In the rare instances of natural recovery, permanent active immunity is established. The disease has not been conclusively demonstrated in any other species.

The virus is spread by bloodsucking insects, chiefly mosquitoes and midges, but fleas and other ectoparasites can carry it. There is no intermediate phase in the vector, and transmission is mechanical (Fenner & Woodroofe, 1953). Infection may also occur by direct contact, and even human contact can convey the virus from an infected to a normal animal.

The incubation period is four to five days, and death occurs from three to ten days from the onset of symptoms. The earliest symptom is blepharoconjunctivitis, followed by swelling round the nose and mouth, and a copious nasal discharge which is loaded with virus. Myxomatous swellings appear in various parts of the body, with rapid wasting and terminal pyrexia.

Epidemiology.—Myxomatosis will readily spread to laboratory rabbits unless precautions are taken to deal with it. There is little chance of spread during the winter months but it is very likely to flare up in the spring and summer. Even if the present outbreaks are stamped out by complete destruction of the affected wild rabbit populations, further outbreaks are to be expected. The rapidity with which the disease has spread in Australia (Ratcliffe, Myers, Fennessy & Calaby, 1952; Fenner & Day, 1953) is an indication of the explosive potentialities of this infection. Preparations for the protection of laboratory stocks should therefore be made without delay.

Prophylaxis

(a) *Control of Vectors.*—Wherever possible, vectors should be prevented from entering rabbit houses. This will involve proofing windows, ventilators and other openings against mosquitoes and midges; the provision of air-lock doors; change of outer garments and footwear for those entering the rabbit house; and the use of insecticides within the house, for example by means of aerosols. To be effective, these precautions must be very thorough, and among other things call for a high standard of discipline in animal house personnel.

(b) *Control of Cases and Contacts.*—Immediate killing of cases in the early stage of blepharoconjunctivitis, burning the carcases, and disinfection of the cages, are essential precautions. Contacts should be isolated for seven days. Wholesale destruction of contacts, even of cage mates, is not necessary.

(c) *Immunisation.*—Vaccination with the Boerlarge strain of the Shope (1935) fibroma virus confers a strong immunity to myxomatosis lasting for at least 12 months (Whitten, 1953). The vaccine is injected intradermally or subcutaneously. A soft fibromatous swelling appears in about five days, reaches its maximum at seven to eight days and then regresses, disappearing finally in 20 to 30 days. Immunity to myxoma virus is established before the 14th day. Vaccination is ineffective in rabbits already infected with myxomatosis.

Recommendations

1. Rabbit houses or rooms should be proofed against mosquitoes as far as possible.

2. A change of outer clothing should be provided for those entering and leaving the rabbit house.

3. The use of insecticides, particularly aerosols, should be encouraged.

4. Cases should be killed, in the stage of blepharoconjunctivitis if possible, and carcases burned. Contacts should be isolated for seven days.

5. In many cases, if not most, there will be no alternative to vaccination of all the rabbits in the animal house.

6. If rabbits are obtained from elsewhere, *e.g.*, from another laboratory or from a breeder or dealer, the risk of their being infected must be accepted. In this connection the Laboratory Animals Bureau should be consulted. It would certainly be possible to arrange for the vaccination of accredited breeders' rabbits, and possibly of those of other breeders as well. How far the Bureau is able to help dealers will depend on the extent to which the dealers are willing to accept help and some measure of control. Some of them will be, but others are likely to decline.

Vaccination.—Until the Carrington Committee has reported it is not possible to say where the vaccine is to be obtained, or what the recommended dose and vaccination technique are. A further note about this will be circulated as soon as the information is available.

It is very strongly urged that some system of marking rabbits which have been vaccinated be adopted. The best methods are nicking, punching or tattooing the ear: the choice must depend upon local circumstances.

References.—Publications on the subject of myxomatosis in rabbits are numerous, and no attempt is here made to give even a selective bibliography. The following references will, however, serve as an introduction.

Fenner, F., & Day, M. F. (1935). *Sci. News.* **28.** 7 (published by Penguin Books).

—— & Woodroofe, G. M. (1953). *Brit. J. exp. Path.* **34.** 400.

Ratcliffe, F. N., Myers, K., *et al.* (1952). *Nature.* **170.** 7.

Sanarelli, G. (1898). *Cbl. Bakt.* Abt. 1 Orig. **23.** 865.

Shope, R. E. (1935). *J. exp. Med.* **63.** 43.

Whitten, W. K. (1953). Australian National University, personal communication.

ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax:

Ches.—Lily Farm, Lily Lane, Byley, Nr. Middlewich (Nov. 19).
Cumberland.—Bowness Hall Farm, Bowness on Solway, Carlisle (Nov. 19).
Sussex.—Peakes Farm, Chiddingley, Lewes (Nov. 18).
Westmorland.—Home Farm, Lowther, Penrith (Nov. 17).
Yorks.—Village Farm, Little Ouseburn (Nov. 18).

Fowl Pest:

Essex.—Moat Farm, Stanway, Colchester (Nov. 19).
Hants.—203, Market Street, Eastleigh (Nov. 19).
Kent.—"Mereworth," Wrotham Road, Northfleet, Gravesend (Nov. 18).
Leics.—Devon Farm, Hobson's Road, Leicester (Nov. 19).
Lincs.—Pye Wipe Inn, Lincoln (Nov. 19).
Norfolk.—118, Bexwell Road, Downham Market (Nov. 19).
Sussex.—Worth Mendham Farm, Chichester (Nov. 19).
Warwicks.—10, The Grove, Hampton-in-Arden, Birmingham (Nov. 18).
Yorks.—55, Tyersal Road, Bradford (Nov. 18).

Swine Fever:

Cambs.—The Grip Farm, Linton; Church Lane, Dullingham, Newmarket (Nov. 20).
Ches.—Yew Tree Farm, Betchton, Nr. Sandbach; Wardle Brook Farm, Further Lane, Hyde (Nov. 18); Pump Farm, Chester Road, Woodford, Bramhall, Stockport (Nov. 19).
Devon.—Culver House, Chudleigh, Newton Abbot (Nov. 19).
Essex.—Homeleigh, Hempstead, Saffron Walden (Nov. 18).
Glamorgan.—30, Metcalfe Street, Caerau, Maesteg (Nov. 18).
Hereford.—Dannygraig, Grosmount, Hereford (Nov. 20).
Herts.—Rosemead Farm, Hadleigh, Barnet; Apsleybury Farm, Shillington, Hitchin (Nov. 20).
Isle of Ely.—Rectory Road, Outwell, Wisbech (Nov. 18); Chear Farm, Stretham (Nov. 20).
Lincs.—Jekylls Farm, Holbeach St. Johns, Spalding; Moores Yard, Eye, Peterborough (Nov. 19); No. 2 Holding, Boston Road, Gosberton, Risegate, Spalding; The Old Rectory, Bennington, Boston (Nov. 20).
Montgomery.—Post Office, Leighton, Nr. Welshpool (Nov. 19).
Salop.—Wrockwardine Bank Farm, Wrockwardine, Wellington (Nov. 18).
Staffs.—St. George's Hospital Farm, Stafford (Nov. 20).
Suffolk.—Ringsfield Hall, Beccles (Nov. 18).
Surrey.—Woodlands Farm, Woodlands Road, Guildford (Nov. 19.)
Sussex.—Rowhook Manor Estate, Warnham, Horsham (Nov. 18).
Yorks.—Howley Hall Farm, Scotchman Lane, Morley, Leeds (Nov. 19).

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UNIVERSITY OF LONDON B.Sc. (VETERINARY SCIENCE)

Following is the Pass List for the above Examination, October, 1953: Biggs, Peter Martin; Clay, Daniel; Fell, Bernard Francis, and Lane, Denis Richard, all of the Royal Veterinary College.

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VETERINARY HYGIENE AND HUMAN WELFARE

Professor Robertson's Inaugural Lecture

"There is a tide in the affairs of men which taken at the flood leads on to fortune" was the main theme of Professor Robertson's Inaugural Lecture in Edinburgh. Professor Robertson, basing his opinion on evidence obtained from personal observation in various parts of the world and on critical evaluation of the problems of a rapidly increasing world population, considered that the veterinary profession should show its worth

by playing a full part in leading the world out of the dilemma of too little food for too many people.

Veterinary Preventive Medicine is widely understood as the branch of applied biology which seeks to reduce or eradicate the major diseases of animals, but this, in the lecturer's opinion, is a limited outlook and he suggests that if our profession accepts such a myopic view we will not only throw away our opportunity but will at the same time emphasise rather than disprove the correctness of Malthusian theory. It is essential that animal health should be accompanied by maximum productivity of the land, otherwise overstocking, drought and famine, soil erosion and desolation will be the end result rather than increased food for the 1,500,000,000 of our fellow human beings who are now surrounded by poverty, disease and squalor, perpetually undernourished and cruelly familiar with famine and starvation. Professor Robertson insists that the profession can play its full part only if it has control of both livestock production and disease prevention. He is, nevertheless, very conscious of the part which animal husbandry experts must also play but believes that those without a sound training in pathology and epidemiology are not equipped to overcome the obstacles in the way of full health and productivity.

The veterinary profession demanding such, however, must be sure that the graduates of the veterinary schools have not only the technical ability but also the enthusiasm and the vision for such tasks. This has not always been the case since, as Professor Robertson pointed out, William Dick himself never really appreciated the necessity for preventive medicine nor realised its potentialities, for he regarded the epizootic diseases as being non-contagious. Such views were by no means confined to Dick. Since then preventive medicine has been taught by some as applied bacteriology, but consideration of a host of conditions such as aphosphorosis and cobalt deficiency—to mention but two—has shown that such a restricted outlook is now untenable. Indeed, many bacterial diseases may have a primary nutritional or environmental factor to say nothing of such factors in helminthology and protozoology.

Others have encompassed the subject within the confines of veterinary medicine but Professor Robertson considers that the clinical field is already too wide even without the responsibility of preventive medicine. Such excessive demands on any one professor lead inevitably to a superficiality of approach, to the detriment of the vital fields of diagnosis and treatment. Moreover, many important prophylactive measures have little clinical significance: for example, the adequate control of swill in the prevention of swine fever.

Educational systems like animal organisms must adapt themselves to environmental changes if they are not to degenerate and decay. The lecturer deems it essential for the veterinary schools to give special emphasis to the many technical, financial and political factors involved in ensuring healthy and productive livestock in a herd or in a community and he considers that the Edinburgh Veterinary School has taken the lead in this branch of educational evolution as in so many others.

Professor Robertson next considered the disease position in the world in general. If one looked past the steady stream of accidents, dystokias and sporadic ailments one could divide the disease history of a country into three phases (*a*) eradication of the devastating diseases; (*b*) chronic bacterial infections and parasitic infestations, which are much more difficult to attack than (*a*); (*c*) various nutritional and metabolic disorders, the solution to which eludes us as yet.

Over most of the earth's surface the struggle is still in the first stage, only Western Europe and the Scandinavian countries in the old world having the major epidemic diseases under control, and even there foot-and-mouth disease must be excepted. Only a small section of the earth's surface is now tackling the second stage (Western Europe, Scandinavia, North America and the Antipodes) and the task is not easy. Scandinavia has been the most successful and she has had no easier problem than we have to face in Britain. Africa, South America, India and Asia have enormous problems in all three phases.

Professor Robertson thinks that there is urgency to tackle the problems of the tropics and insists that adequate post-graduate instruction must be forthcoming. He considers that Edinburgh has a unique opportunity to develop such a post-graduate school to study for the diploma in tropical veterinary medicine. The need is urgent, the opportunity unique.

J. T. S.

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

SURVIVAL OF DEEP-FROZEN MAMMALIAN SPERMATOZOA

Sir,—In this Department we have been investigating since 1949 the survival of mammalian spermatozoa frozen to −79° C. We have worked primarily with sheep but have frequently checked the applicability of our methods to cattle and other species. We reported in 1950 the revival of frozen ram and bull spermatozoa (Emmens & Blackshaw, 1950), with resumption of active wave motion in the semen. The ejaculates on freezing contained 7·5 per cent. (V/V) of glycerol and 1·25 per cent. (W/V) of arabinose.

More recently we have diluted the semen with 50 per cent. egg yolk citrate before cooling: this has been found to give more consistent results, somewhat better revival and increased longevity on thawing. Typically, the thawed semen shows only slightly less activity than in the original specimens and would be taken for a first-class fresh ejaculate by anyone unaware that it has been frozen. Similar degrees of revival do not seem to have been encountered elsewhere, except for one mention of "swirling motion" in a goat ejaculate (Smith & Polge, 1950).

Equilibration with the glycerol-arabinose medium is unnecessary and the whole process is completed in one day; neither of these points seems to have been appreciated by Polge (1953) and Bruce (1953) in the report of the recent Symposium of the Society for the Study of Animal Breeding. Bull semen frozen without equilibration is fertile, but ram semen, although of very good activity, gives a lambing rate of only about 10 per cent. Equilibration, however, does not improve this (Emmens & Blackshaw, 1953). Rowson (1953) reports that thin semen with a low sperm count freezes much more satisfactorily than high density samples. This is contrary to our own experience in that dense suspensions appear, if anything, to revive better than those of low density, but since the revival is so good in either case it is difficult to make any distinction. Specimens of bull semen thawed after nine months' storage have shown no apparent loss in activity during that time.

The importance of cooling to 5° C. before adding the glycerol-containing diluent has been stressed in the symposium, but we have found that with semen diluted in egg yolk citrate, the glycerol-arabinose diluent may be added at temperatures up to 15° C. without any harmful effect on revival. Fertility has not yet been tested.

As far as we have been able to follow the accounts of the Mill Hill team, their frozen bull semen was not obtained fertile until 1952 (Polge & Rowson, 1952a, b). Our first (still-born) lamb resulting from insemination with frozen semen was born in 1951, and we have since shown that the method we described in 1950 gives fully fertile bull semen. Our preoccupation with sheep, however, meant that we did not test the bull semen for fertility at that stage.—Yours faithfully, A. W. Blackshaw, *Research Fellow;* C. W. Emmens, *Professor of Veterinary Physiology,* The University of Sydney, Department of Veterinary Physiology. *November 11th,* 1953.

References

Bruce, W. (1953). *Vet. Rec.* **65.** 562.

Emmens, C. W., & Blackshaw, A. W. (1950). *Aust. Vet. J.* **26.** 226.

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